The US Army's Center for Strategy and Force Evaluation

MEMORANDUM REPORT
CAA-MR-92-54

AD-A255 948

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CONVENTIONAL ARMS REDUCTION GAME - OPTIMIZED (CARG-O)

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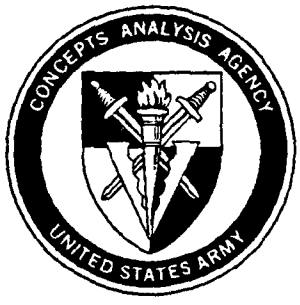

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SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved OMB No 0704-0188

1a. Report Security Classification: UNCLASSIFIED	1b. Restrictive Markings
2a. Security Classification Authority	3. Distribution/Availability of Report
2b. Declassification/Downgrading Schedule	
4. Performing Organization Report Number(s): CAA-MR-92-54	5. Monitoring Organization Report Number(s)
6a. Name of Performing Organization: US Army Concepts Analysis Agency	6b. Office Symbol (if applicable) / 7a. Name of Monitoring Organization
6c. Address (City, State, and ZIP Code): 8120 Woodmont Avenue Bethesda, MD 20814-2797	7b. Address (City, State, and ZIP Code)
8a. Name of Funding/Sponsoring Organization: CAA	8b. Office Symbol (if applicable) / 9. Procurement Instrument Identification Number
8c. Address (City, State, and ZIP Code): 8120 Woodmont Avenue Bethesda, MD 20814-2797	10. Source of Funding Numbers

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO

11. Title (Include Security Classification): Conventional Arms Reduction Game - Optimized (CARG-O)

12. Personal Author(s): LTC John M. Haetinger, Ms. Rosie H. Brown, CPT Frank D. Connor

13a. Type of Report	13b. Time Covered	14. Date of Report (Year, Month, Day)	15. Page Count
Final	From 880711 To 920815	August 1992	53

16. Supplementary Notation

17. COSATI Codes			18. Subject Terms (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	

19. Abstract (Continue on reverse if necessary and identify by block number)

This research analysis activity incorporated historical insights from conventional arms reductions games and studies into a computer enhanced process designed to provide orientation and insight into the complexities involved in conducting arms control negotiations and documented the process.

20. Distribution/Availability of Abstract	21. Abstract Security Classification
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	UNCLASSIFIED

22a. Name of Responsible Individual	22b. Telephone (Include Area Code)	22c. Office Symbol
LTC John M. Haetinger	(301) 295-1647	CSCA-SPC

DD Form 1473, JUN 86 Previous editions are obsolete. SECURITY CLASSIFICATION OF THIS PAGE

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MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: The Conventional Arms Reduction Game - Optimized (CARG-O) Model Research Analysis Activity (RAA)

1. The purpose of this report is to document the evolution of the Conventional Arms Reduction Game - Optimized (CARG-O). It provides sufficient information to understand the CARG-O methodology and the capability to adapt the game to any conventional arms reduction scenario. CARG-O is a computer-assisted interactive model designed to provide orientation and insight into the complexities involved in conducting arms control negotiations.

2. The Conventional Arms Reduction Game (CARG) was originally adapted from a nuclear arms control simulation in 1988. The methodology was validated during PEACEGAME, an arms control simulation game later in that same year, and was utilized in MORNING CALM 90, a political-military game for Commander in Chief (CINC), US Forces Korea (USFK) which examined US requirements for future arms reduction negotiations on the Korean peninsula.

3. The CARG methodology was enhanced and applied to arms control negotiations in the Joint Korean Arms Control Study (JKACS), Phase II, conducted at the U.S. Army Concepts Analysis Agency (CAA) from 13 to 24 July 1992. JKACS is a joint, multiyear, phased analytical effort to develop a range of candidate arms control proposals, evaluate resulting arms control packages in terms of their contributions to national objectives, and then submit them to national authorities.

4. Questions and/or inquiries should be directed to the Assistant Director, Strategy and Plans Directorate, U.S. Army Concepts Analysis Agency, 8120 Woodmont Avenue, Bethesda, MD 20814-2797, DSN 295-1680.

E. B. VANDIVER III
Director

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MEMORANDUM REPORT
CAA-MR-92-54

CONVENTIONAL ARMS REDUCTION GAME - OPTIMIZED (CARG-0)

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Availability Codes	
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August 1992

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This document was prepared as part of an internal CAA project.

SUMMARY

THE REASON FOR THE RESEARCH AND ANALYSIS ACTIVITY (RAA) was to incorporate historical insights from conventional arms reduction games and studies into a computer enhanced process designed to provide orientation and insight into the complexities involved in conducting arms control negotiations.

THE RAA SPONSOR was Chief, Conflict Analysis Center, Strategy and Plans Directorate, US Army Concepts Analysis Agency (CAA).

THE RAA OBJECTIVES were to:

(1) Conduct a detailed analysis of the current Republic of Korea (ROK)/US conventional arms control process.

(2) Provide enhancements to the process that will optimize the use of available resources (to include computer hardware, software, and personnel).

(3) Take full advantage of the insights gained from earlier conventional arms reduction games and studies.

(4) Document the Conventional Arms Reduction Game - Optimized (CARG-O).

THE SCOPE OF THE RAA was to enhance the Conventional Arms Reduction Game (CARG) methodology and apply it to arms control negotiations conducted in the Joint Korean Arms Control Study (JKACS).

THE MAIN ASSUMPTION of this RAA is that users possess a working knowledge of the Excel 3.0 software and a basic understanding of spreadsheets and algebraic expressions.

THE BASIC APPROACH used in this RAA was to:

(1) Review the objectives, assumptions, methodology, and game conduct associated with the game's utilization as presented in:

(a) Inception - adaptation from a nuclear arms control simulation, 1988.

(b) PEACEGAME - an arms control simulation specifically conducted to validate the Conventional Arms Reduction Game (CARG) methodology.

(c) MORNING CALM 90 - CAA used CARG in support of a political-military game to examine US requirements for future Korean arms reduction negotiations.

(2) Construct a display enhanced spreadsheet within the framework of the Excel 3.0 software package on a Macintosh computer system. The enhancement includes geographic and three-dimensional displays.

(3) Completely document the process for future application.

THE RAA EFFORT was directed by Ms. Rosie H. Brown, Conflict Analysis Center, Strategy and Plans Directorate, US Army Concepts Analysis Agency.

COMMENTS AND QUESTIONS may be sent to the Director, US Army Concepts Analysis Agency, ATTN: CSCA-SPC, 8120 Woodmont Avenue, Bethesda, Maryland 20814-2797.

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CONVENTIONAL ARMS REDUCTION GAME - OPTIMIZED (CARG-O)

CHAPTER 1

BACKGROUND

1-1. PURPOSE. The purpose of this paper is to document the evolution of the Conventional Arms Reduction Game - Optimized (CARG-O) from its inception to its current form. This documentation effort should provide the reader with sufficient information to understand the utility of the process and provide the reader a capability to adapt the game to any conventional arms reduction scenario.

1-2. INTRODUCTION

a. This paper presents a detailed description of CARG-O, used in support of the Joint Korean Arms Control Study (JKACS). CARG-O is a computer-assisted interactive model designed to provide orientation and insight into the complexities involved in conducting arms control negotiations.

b. The CARG-O concept originated from a nuclear arms control simulation adaptation in 1988. Although the mechanics of the model have evolved over time, the concept remains intact. This paper will describe the evolution of the game, from its inception, and then present the game as it currently exists, with adequate detail for adaptation in future endeavors.

1-3. INCEPTION. The Conventional Arms Reduction Game (CARG) was originally developed as an adaptation of a nuclear arms control simulation developed by Colonel Fletcher Lamkin of the Department of Engineering, US Military Academy. The test bed for CARG was an arms control (PEACEGAME) simulation conducted 11-14 July 1988, at the US Army Concepts Analysis Agency (CAA). The objective of the exercise was to explore applications of the latter methodology in a conventional arms control context.

1-4. PEACEGAME

a. The original objectives of CARG are as follows:

(1) Teaching tool to assist gamers in understanding the arms control and negotiation processes.

(2) Gain insight on each side's valuation system of current force structure.

(3) Examine how valuations would change as the force structure is reduced.

(4) Examine the impact of force reductions on stability of the Allied Forces, Central Europe (AFCENT) region, as measured by changes in correlation of forces and the Concepts Evaluation Model (CEM) output.

b. The original assumptions are as follows:

(1) Unit of account for Warsaw Pact (WP) ground forces is the combined arms army, which includes all of the army's divisional assets and supporting artillery, helicopter regiments, and antitank units. Unit of account for North Atlantic Treaty Organization (NATO) ground forces is the division, with the exception of the French forces, whose basic unit of account will be the corps.

(2) Unit of account for the WP and NATO air forces is the wing.

(3) Impact of negotiations on stability can be evaluated by an assessment of trends in the correlation of forces (COF); i.e., from the NATO perspective, a decrease in COF may indicate a more favorable situation, while from the WP perspective, this same relative decrease in COF may be acceptable in that they do not feel threatened by a NATO attack. Factors used in the correlation of forces methodology (COFM) will be the best data available; where data is not available, professional judgment will be used.

(4) Impacts of negotiations on stability can also be evaluated by assessment of changes in the simulation output from the CEM. (It is recommended that fiscal year (FY) 89 forces within the context of the Defense Guidance scenario be used in CEM in the interests of time constraints.)

(5) Asymmetric reductions (i.e., NATO air and ground for WP air and ground) will be acceptable to actual NATO and WP negotiators.

(6) Disproportionate reductions (i.e., approximately equal in percentage but unequal in total numbers) are acceptable to both sides.

(7) Game objectives are not significantly restricted by considering only the AFCENT region.

c. The original methodology is as follows:

(1) **General.** This is a two-sided game played between a WP and NATO negotiating team, with the goal of reducing conventional arms by approximately 10 percent over three iterations. During each iteration, each side will be required to evaluate its own systems, then reduce the other side by approximately 3 percent, based on the other side's valuation. The impact of these reductions on the stability of the AFCENT region will be measured after each iteration using the COFM and after the final iteration using the CEM. The primary means of assessment will be the COFM. CEM will be used for additional insight.

(2) **Game Procedure**

(a) **Valuation.** Each team will evaluate its available forces, based on an aggregate 10,000 point total. Other categories of arms reduction will be adjusted by a suitable, controller determined proportion. Once both sides have completed the valuation, the controllers will "swap lists" so that each side knows how the other valued its systems.

(b) **Reduction.** Each team will reduce the other's available forces by 300 points (3 percent of the total), using the valuations given by the opposing team. Fractions of units will not be used, and the total reduction must be equal to or less than 300 points. Points not used in one cycle may not be carried over to the next. Once each team has decided on the reductions to take place, the reductions will be

announced to both sides. Once announced, the reductions will be considered implemented.

(c) **Discussion.** Once the reduction is completed, the teams will be assembled for a brief discussion. A spokesperson for each team will have the opportunity to make a 1-minute, nonrebuttable statement to the other side. Game controllers will update maps and prepare worksheets for the next iteration.

(d) **Continuation.** Players will return to their workplaces and repeat steps (a) through (c) until three iterations are completed (total of 9 percent reduction).

(e) **Termination.** Once three iterations have been completed, teams will be assembled, this time for a brief debate. Each side will have the opportunity for a 2-minute statement and a 1-minute rebuttal.

(f) **Assessment.** After each iteration of the game, controllers will employ COFM to determine trends in stability. After the final move, CEM will be used to simulate the theater combat in AFCENT, and its results will be compared with the baseline. Once results are compiled, controllers will reassemble the groups for a final critique and outbriefing.

d. Results

(1) The first iteration of CARG, using the methodology presented above, surfaced a problem, caused by the fact that by assigning 301 points protected a unit. The Red team assigned 301, 201, or 101 points to all units, so the Blue team could only cut a total of 201 or 202 (2 times 101), or roughly 2 percent, rather than 3 percent.

(2) In a second iteration of CARG, the sides were allowed to save points for later turns in order that the problem of the first iteration be avoided, but this made game playing more complex and thus made it require more of the limited time available to the players.

1-5. MORNING CALM 90

a. Background. The Commander in Chief, United States Forces Korea, requested CAA to examine the US requirements for future Korean arms reduction negotiations.

(1) **History.** The conclusion of the Treaty on Conventional Armed Forces in Europe (CFE) talks had raised the possibility of applying the lessons learned from European arms control to other scenarios. The objectives of the CFE treaty were to promote stability with reduced force levels in Europe, and to reduce capabilities for a surprise attack or large-scale offensive action. Those objectives seemed equally applicable to the Korean Peninsula. Richard H. Solomon, Assistant Secretary of State for East Asian and Pacific Affairs, speaking at the University of California at San Diego on 30 October 1990, said,

> "The one place in East Asia where European-style confidence building measures--and, in time, arms reduction initiatives--seem relevant is the Korean Peninsula. In Korea, as in Europe, large, heavily armed ground forces confront each other across a clearly demarcated land border. As the newly active North-South dialogue proceeds, there is great potential for the

Koreans to apply the arms control experience gained in Europe to reducing tensions and building the confidence necessary for significant arms reductions. And as we have seen this year in Germany, such a dialogue can pave the way for rapid reunification."

(2) Current Situation (December 1990). Serious talks regarding arms reduction on the Korean Peninsula have yet to begin. Aside from unilateral public statements, there have now been no new arms control positions. However, the Democratic People's Republic of Korea (DPRK) and the Republic of Korea (ROK) have been moving closer to high level talks since early 1989. On 8 February 1989, a preliminary meeting was held in preparation for future Prime Ministers' talks. That was the first meeting between military and civilian leaders of both sides. Several meetings followed, suggesting that it was time to examine the arms reduction process. To this end, the Commander in Chief, US Forces Korea, requested MORNING CALM 90 (MC 90), a political-military game. Specific objectives of the game were as follows:

b. MORNING CALM 90 Objectives

(1) Objective 1. Determine each side's expectations from arms reductions.

(2) Objective 2. Determine each side's view on military inventory.

(3) Objective 3. Determine the formula for arms reduction most likely to promote stability on the Korean peninsula.

(4) Objective 4. Examine current agreements to determine if they would be disadvantageous to the US 10 years hence.

(5) Objective 5. Determine a proper role for the US in an arms control initiative, and determine how this role supports the process, while furthering the legitimate interests of the ROK.

(6) Objective 6. Determine if chemical and nuclear weapons control can be included in a conventional arms control agreement.

(7) Objective 7. Determine which lessons from the European case can be applied to the Korean peninsula.

c. Purpose. On 17 and 18 December 1990, 22 experts on Korean political-military affairs met to game arms control on the Korean peninsula, MC 90, for CINC USFK. The purpose was to examine a quantitative force reduction model and to discuss the broader conditions necessary for genuine arms control. Inherent within the scope of the political-military game was the utilization of CARG, which had now evolved into a more simplistic model (less cumbersome in valuation assignment methodology), but maintaining the basic tenets of the original model.

d. Assumptions. The specific assumptions used during MC 90, as it related to CARG, are as follows:

(1) Assumptions from CFE are as follows:

(a) CFE provides a theory of arms control where reduction of equipment, not units or personnel, is the first order of business.

(b) The CFE treaty establishes a standard or model for future arms control negotiations. At a minimum, it establishes the following units of account for conventional force reductions:

1. Tanks.

2. Artillery.

3. Armored personnel carriers.

4. Helicopters.

5. Aircraft.

(2) Other assumptions:

(a) The US and ROK will seek arms reduction zones within the Democratic Peoples' Republic of Korea (DPRK). At a minimum, a forward zone (for warning) and a rear zone will be required.

(b) The DPRK will seek separate ceilings on US and ROK forces.

(c) Talks or agreements on Conventional Armed Forces in Korea (CFK) will presume:

1. Three parties on two sides, DPRK versus ROK and US.

2. Two reduction zones for the DPRK including a forward zone extending back from the demilitarization zone (DMZ) to just below Pyongyang and a rear zone beyond that to the border with the Soviet Union.

3. Equal percentage reductions for each side constitute the objective, not parity as in CFE.

4. No one category of forces (e.g., tanks, artillery) can be entirely eliminated.

e. Game Conduct

(1) **Move 1.** CARG was used during Move 1, which was an exercise in arms reduction, of the MC 90 game. The goal of the first move was to immerse the gamers in a competitive environment that fomented discussion of crucial arms control issues. For the purposes of this game, the move was accomplished in two stages, each corresponding to a facet of CARG.

(2) **First Stage.** Each team was assigned two tasks to be completed in the first stage. First, the team was to develop an arms reduction strategy, and second, it was to assign values to the equipment of its force. To accomplish the latter, each team was provided a force list of its ground and air unit equipment. The equipments were aggregated into five categories: tanks, artillery, armored personnel carriers, helicopters, and aircraft. The team was given 100 points to distribute over equipment categories in accordance with perceived value.

(3) **Second Stage.** Each side was given the opposing side's evaluation of its forces. The two sides, each meeting in caucus, were instructed to reduce the opposing side's forces by 20 percent, i.e., 20 points since each side had distributed 100 points over equipment categories. No side was permitted to reduce a single category of an opponent's equipment by more than half. For example, if the South assigned 20 points to the US aircraft category, the North could only reduce that category to 10 points. The reduction percentage was unknown to the sides prior to exchanging lists.

(4) **Plenary Session.** In the plenary session, each team's unique interests were discussed against a backdrop of a real situation. Specifically, the team leaders presented the reasoning behind their evaluation of categories and their selection of reductions from the opposing side's equipment categories.

(5) **Impact.** Completion of the reduction process marked the end of Move 1. While gamers recessed, combat between the reduced forces of the opposing sides was simulated on computer, using the CEM and the RAND Strategy Assessment System (RSAS). Gamers were provided with the list of force reductions made by the opposing side during the second stage of Move 1 and their impact on combat, as measured by the simulations.

f. Lessons Learned. The following insights represent the lessons that were learned from the implementation and utilization of CARG during the MC 90 political-military game:

(1) CARG provided gamers with orientation and insight into the complexities involved in conducting arms negotiations.

(2) CARG compelled gamers to define their team's strategy and the relative value of their team's force, and to propose a possible negotiating policy.

(3) CARG assessed which forces are highly valued and which are perceived as most threatening by each team.

1-6. JOINT KOREAN ARMS CONTROL STUDY (JKACS)

a. Background

(1) **History.** CINC USFK and the President of Korea's Institute for Defense Analysis (KIDA) agreed at the US/KO Defense Analysis Seminar VI (DAS VI) in Seoul (Sep 91) to sponsor the Joint Korean Arms Control Study (JKACS) [NOTE: background information on KIDA and the Arms Control Research Center is located in Appendix D]. CAA's MC 90 political-military game conducted for CINC USFK in Dec 90 to examine arms control issues on the Korean Peninsula provided an important catalyst for the JKACS decision. MC 90 key insights were provided to the CINC in Jan 91 and reported comprehensively at DAS VI. Mr. Walter Hollis, DUSA(OR), led the US Army delegation assisted by key leaders of the Army's analytical community--Mr. E. B. Vandiver III, Director, CAA; Mr. John Riente, Technical Advisor, ODCSOPS; Dr. Richard Darilek, RAND Arroyo Center; et al. General RisCassi, CINC USFK and President Sung, KIDA, approved draft Terms of Reference (TOR). Senior National Representatives (SNRs) signed the final JKACS TOR at CAA on 1 Oct 91. A concept of analytical operations was initiated immediately.

(2) Scope

(a) JKACS is a joint, multiyear, phased analytical effort to develop a range of candidate arms control proposals, evaluate resulting arms control packages in terms of their contribution to national objectives, and then submit them to national authorities.

(b) JKACS covers the full spectrum of arms control possibilities for nuclear, chemical, and biological, conventional air and land forces, and both operational and structural measures and regimes.

(3) Approach. KIDA, CAA, and RAND Arroyo Center comprise the three legs of the JKACS analytical triad with each agency leading a phase. KIDA began by leading a series of arms control seminars in Phase I to survey past arms control proposals, forecast future regional and strategic environments, develop national objectives, and develop alternative packages of arms control measures for further evaluation. KIDA coordinated and finalized these packages by Jun 92. CAA's Conflict Analysis Center is developing and conducting a series of synergistic political-military games to lead Phase II and evaluate the arms control packages. Key insights generated by the political-military games will be augmented by an analytical arsenal of quantitative methods. The Arms Control Evaluation Report (ACE) will be submitted to analytical SNRs and the sponsors by Dec 92. The ACE report will provide a basis to finalize negotiating strategies in Phase III by Aug 93 under RAND Arroyo's lead. Phase IV begins with DAS VII in September 93 and will initiate dissemination of JKACS results to the ROK and US national leadership.

b. JKACS was conducted at CAA from 13 to 24 July 1992. The purposes of JKACS, Phase II, were:

(1) Develop range of candidate arms control proposals.

(2) Evaluate arms control packages in terms of contribution to national objectives.

(3) Submit to national authorities.

c. CARG was one of several games used during the conduct of JKACS. The basic tenets of the game had been maintained; however, due to technological breakthroughs in software application techniques, it was now possible to provide the gamer with immediate feedback via geographical and three-dimensional representation of the results. Hence, the generation of the Conventional Arms Reduction Game - Optimized (CARG-O) was now possible. The "optimized" portion of the title refers only to the software enhancements that were incorporated into the game and in no way refers to an optimized methodological gaming technique. The CARG methodology was defined within the Spreadsheet Excel 3.0 software package on a Macintosh computer system. This allowed for a direct interface between spreadsheet cell values and three-dimensional output displays. The utilization of Adobe Illustrator further enhanced the output displays by allowing incorporation of geographic limited deployment zone (LDZ) displays.

d. The MC 90 political-military game experience proved invaluable in terms of the CARG assumptions. The validity of the assumptions was established, at least within the framework of the game, and were therefore deemed appropriate for use within JKACS. The specific assumptions used during JKACS, as it related to CARG-O, are as follows:

(1) The assumptions from CFE are as follows:

(a) CFE provides a theory of arms control where reduction of equipment, not units or personnel, is the first order of business.

(b) The CFE treaty establishes a standard or model for future arms control negotiations. At a minimum, it establishes the following units of account for conventional force reductions:

1. Tanks.

2. Artillery.

3. Armored personnel carriers.

4. Helicopters.

5. Aircraft.

(2) Other assumptions.

(a) The US and ROK will seek limited deployment zones within the DPRK and ROK.

(b) Any talks or agreements on CFK will presume:

1. Up to three parties on two sides.

2. A DPRK versus ROK and US scenario.

3. Three reduction zones for DPRK and ROK/US.

4. No one category of forces (e.g., tanks, artillery) can be entirely eliminated. No side was permitted to reduce a single category of the opponent's equipment by more than half.

(c) It should be noted that the initial assumptions for CARG-O were drawn from two sources: the MORNING CALM 90 game experience and the Study for Arms Control Measures in Korean Peninsula, by KIDA, dated 30 June 1992. It should also be noted that the original assumptions were modified prior to the actual conduct of the game. One of the modifications was a symmetrical LDZ proposal, based upon four LDZs, each having a north-south oriented depth reference:

1. Zone 1 was adjacent to the DMZ and was 50 kilometers in depth.

2. Zone 2 was adjacent to Zone 1 and also was 50 kilometers in depth.

3. Zone 3, adjacent to Zone 2, was 200 kilometers in depth and had a restriction/stipulation that no forces would be deployed/stationed within the zone.

4. Zone 4 represented the geographic remainder of each respective country.

An additional modification was the assumption that DPRK would unilaterally reduce its forces to ROK levels. Note that parity between opposing sides is not required to utilize CARG-O.

e. Game Conduct. CARG-O was conducted in what was referred to as stages.

(1) Stage 1 - DPRK unilaterally reduces to ROK levels. This stage of CARG-O was essentially performed by the game controllers by proportionally reducing DPRK force levels to commensurate aggregate ROK figures. The proportional geographic distribution of forces was maintained.

(2) Stage 2 - redistribution of team forces within the three applicable LDZs. This redistribution was performed by each respective team, with no restriction placed on the amount of forces distributed within any of the three applicable LDZs.

(3) Stage 3 - assess a 30 percent reduction. This was conducted in three moves.

(4) Stage 4 - assess an additional 20 percent reduction. Once again this was conducted in three moves, with initialized force distribution values equal to the Stage 3 resultant force values. The gamer instruction sheet and worksheet, used during JKACS, are located in Appendices A and B, respectively.

f. CARG-O Moves

(1) Move 1 - the equipments were aggregated into 11 categories: tanks, artillery, armored personnel carriers, helicopters, and aircraft, as apportioned within the three LDZs. The helicopters and aircraft were handled irrespective of zones. The team was given 100 points to distribute over the 11 equipment categories in accordance with perceived value.

(2) Move 2 - each side was given the opposing side's force valuation worksheets. The two sides were instructed to reduce the opposing side's forces by whatever reduction percentage was applicable. As in MORNING CALM 90, no side was permitted to reduce any of the opponent's eleven equipment categories by more than half.

(3) Move 3 - the plenary session, in which the team leaders presented the rationale behind their force valuations and reduction strategies. During the conduct of the plenary session, the CARG-O spreadsheet was updated, thereby allowing immediate feedback to the gamers in a compelling geographical and three-dimensional display.

(4) Impact. Completion of the plenary session marked the end of a Stage. While gamers recessed, combat between the reduced forces of the opposing sides was simulated on computer, using the CEM. Gamers were later provided with a detailed descriptive briefing concerning the impact of the reductions, as measured by the simulation.

1-8. GENERAL DESCRIPTION

a. The CARG-O model is constructed within the framework of a spreadsheet format and executed within the Excel 3.0 software package, on a Macintosh computer system. The spreadsheet format that was used during JKACS will be discussed in detail in Chapter 2.

b. The output displays of the spreadsheet were enhanced through the use of three-dimensional representations of the results. These 3-D charts were constructed through the internal graphics capabilities of Excel 3.0. By pasting the 3-D charts to the appropriate output sections of the spreadsheet, an internal responsive linkage was created, whereby the charts were updated as soon as any portion of the spreadsheet was modified.

c. The output displays were also enhanced through the incorporation of geographical displays, which highlighted the affected/negotiated areas of arms reductions.

d. Other utilities, available in the Excel 3.0 software package, known as Macros, were incorporated into the model to allow for responsive navigation within the spreadsheet and responsive results depiction.

e. The total computer environment within which the CARG-O model exists allows for an interactive, user-friendly, and highly responsive capability.

CHAPTER 2

CARG-O MODEL

2-1. INTRODUCTION. This chapter provides a detailed description of the CARG-O model. The organization of the spreadsheet is introduced through the use of a flow diagram, as shown in Figure 2-1. An explanation of each section of the spreadsheet is provided with an illustrative example. The spreadsheet construction requirements are presented with enough detail to allow replication in other endeavors. The chapter ends with the lessons learned from CARG-O's use in JKACS and a proposed model enhancement to offset some of the more debated assumptions, specifically the LDZ concept with force restrictions imposed in one of the zones .

2-2. FLOW DIAGRAM. Figure 2-1 shows a very simplistic flow diagram, which depicts the various sections of the CARG-O spreadsheet.

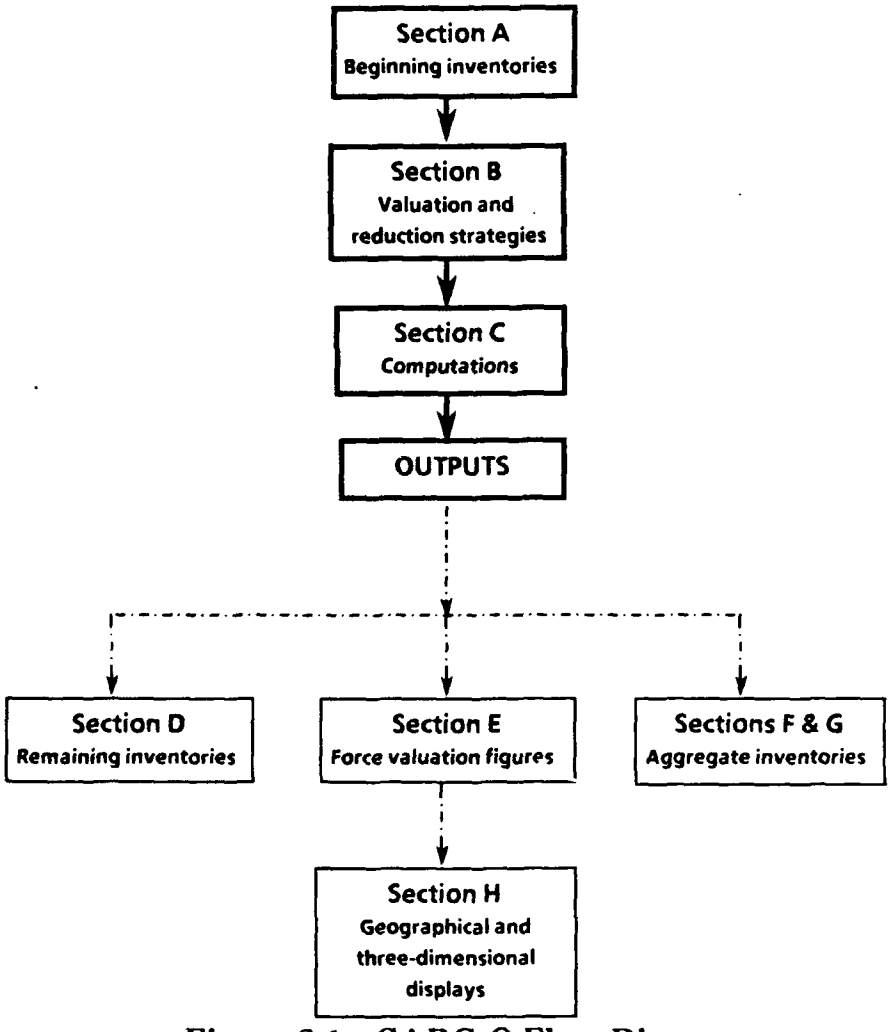

Figure 2-1. CARG-O Flow Diagram

2-3. SPREADSHEET LAYOUT (ORGANIZATION). A spreadsheet similar to the one used for CARG-O, during JKACS, is shown in each of the section descriptions. This spreadsheet organization shows a "Zone 3," unlike that used during JKACS. Appendix C contains a copy of the spreadsheet, as depicted within Excel 3.0. Although the spreadsheet can be limited or abbreviated into only two sections, the approach that was used in JKACS greatly facilitated the results presentation portion. (NOTE: all spreadsheet tables and figures are illustrative only; equipment figures are fictitious.)

a. Section A (Table 2-1) contains the initial, or beginning, inventories for each of the equipment categories, subcategorized by preestablished zones within each of the respective geographic areas. (NOTE: the helicopter and fixed wing categorical inventories are displayed under the aggregate columns, since they were not restricted by zones.)

Table 2-1. Section A - Beginning Inventories

SECTION A	nK ZONE1	nK ZONE2	nK ZONE3	nK ALL	ROK ZONE 1	ROK ZONE 2	ROK ZONE 3	ROK ALL
TANKS	1200	1475	320		1150	1250	280	
APCS	1345	870	450		980	460	225	
ARTY	4850	4380	1245		1650	1235	830	
HEL				785				680
A/C				440				820

b. Section B (Table 2-2) displays the valuation and reduction figures that are imposed during CARG-O Moves 1 and 2. The figures are categorized by opposing forces (OPFOR)/friendly forces (FRNDFOR), equipment categories and geographical zones. Section B is the only section of the spreadsheet that requires user input during the actual conduct of the game. All other sections of the spreadsheet are prepared prior to the game such that the individual cell values within each remaining section of the spreadsheet are updated automatically as the valuation and reduction figures are input into Section B.

Table 2-2. Section B - Valuation and Reduction

SECTION B	ZONE 1 TANKS	ZONE 2 TANKS	ZONE 3 TANKS	ZONE 1 APCS	ZONE 2 APCS	ZONE 3 APCS	ZONE 1 ARTY	ZONE 2 ARTY	ZONE 3 ARTY	HELO	A/C	TOTAL
OPFOR												
nK VALUES FORCE	18	14	5	10	6	5	22	8	2	5	5	100
REDUCTION BY ROK	9	7	0	3	0	0	11	0	0	0	0	30
FRNDFOR												
ROK VALUES FORCE	16	8	2	10	4	1	25	13	6	7	8	100
REDUCTION BY nK	8	0	0	0	0	0	12	2.5	0	3.5	4	30

c. Section C (Table 2-3) represents the heart of the spreadsheet, all computations. First of all, it, too, is broken down into OPFOR and FRNDFOR subsections. Within each of the subsections are defined the zone and equipment categories, all presented as column headings. Each cell within this section contains formulas, based on the cell values within Sections A and B. The "beginning inventory" row entries are preset to equal the appropriate cells of Section A. The "values force" row entries are preset as well to equal the respective cell values from Section B. The "points per

item" entries are calculated by dividing the force valuation entries by the respective inventory entries. The "reduction" values that are imposed by the opposing team are pre-set to equal the appropriate cell values of Section B. The "inventory eliminated" figures are calculated by dividing the respective reduction values by the valuation figures and multiplying the quotient by the respective beginning inventory figure. The "remaining inventory" values are calculated by subtracting the inventory eliminated from the beginning inventory.

Table 2-3. Section C - Computations

SECTION C	ZONE 1 TANKS	ZONE 2 TANKS	ZONE 3 TANKS	ZONE 1 APCS	ZONE 2 APCS	ZONE 3 APCS	ZONE 1 ARTY	ZONE 2 ARTY	ZONE 3 ARTY	HELO	A/C	TOTAL
OPFOR												
BEGINNING INVENTORY	1200	1475	320	1345	870	450	4850	4380	1245	785	440	
nK VALUES FORCE	18	14	5	10	6	5	22	8	2	5	5	100
PTS-PER-ITEM	0.015	0.009	0.015	0.007	0.007	0.011	0.005	0.002	0.002	0.006	0.011	
REDUCTION BY ROK	9	7	0	3	0	0	11	0	0	0	0	30
INVENTORY ELIMINATED	600	738	0	404	0	0	2425	0	0	0	0	
REMAINING INVENTORY	600	737	320	941	870	450	2425	4380	1245	785	440	
FRNDFOR												
BEGINNING INVENTORY	1150	1250	280	980	460	225	1650	1235	830	680	820	
ROK VALUES FORCE	16	8	2	10	4	1	25	13	6	7	8	100
PTS-PER-ITEM	0.013	0.006	0.007	0.010	0.009	0.004	0.015	0.011	0.007	0.010	0.010	
REDUCTION BY nK	8	0	0	0	0	0	12	2.5	0	3.5	4	30
INVENTORY ELIMINATED	575	0	0	0	0	0	792	238	0	340	410	
REMAINING INVENTORY	575	1250	280	980	460	225	858	997	830	340	410	

d. Section D (Table 2-4) displays the remaining inventories, drawn directly from the appropriate rows within Section C.

Table 2-4. Section D - Remaining Inventories

SECTION D	nK ZONE1	nK ZONE2	nK ZONE3	nK ALL	ROK ZONE 1	ROK ZONE 2	ROK ZONE 3	ROK ALL
TANKS	600	737	320		575	1250	280	
APCS	941	870	450		980	460	225	
ARTY	2425	4380	1245		858	997	830	
HELO				785				340
A/C				440				410

e. Section E (Table 2-5) shows the force valuation data. The valuation of one's own force, based on a 100-point total, is drawn directly from the appropriate entries in Section B. In order to normalize the valuation of a force's equipment by the opposing side, the appropriate reduction figures imposed in Section B are divided by the total reduction points and are presented as percentage figures. This allows for a quick comparison of the assessment concerning which forces were highly valued and which were perceived as most threatening.

Table 2-5. Section E - Force Valuation Figures

SECTION E	TANKS	APCS	ARTY	HELICOPTERS	AIRCRAFT
nK VALUES ROK ZONE 1	27	0	40	12	13
nK VALUES ROK ZONE 2	0	0	8		
nK VALUES ROK ZONE 3	0	0	0		
ROK VALUES ROK ZONE 1	16	10	25	7	8
ROK VALUES ROK ZONE 2	8	4	13		
ROK VALUES ROK ZONE 3	2	1	6		
nK VALUES nK ZONE 1	18	10	22	5	5
nK VALUES nK ZONE 2	14	6	8		
nK VALUES nK ZONE 3	5	5	2		
ROK VALUES nK ZONE 1	30	10	37	0	0
ROK VALUES nK ZONE 2	23	0	0		
ROK VALUES nK ZONE 3	0	0	0		

f. Sections F and G (Tables 2-6 and 2-7) simply display the aggregate categorical inventory figures and are determined by adding the appropriate cells from Section C.

Table 2-6. Section F- Aggregate Beginning Inventory

SECTION F: BEGINNING INVENTORIES	nK	ROK
TANKS	2995	2680
APCS	2665	1665
ARTY	10475	3715
HELO	785	680
A/C	440	820

Table 2-7. Section G - Aggregate Remaining Inventory

SECTION G: REMAINING INVENTORIES	nK	ROK
TANKS	1657	2105
APCS	2261	1665
ARTY	8050	2685
HELO	785	340
A/C	440	410

g. Section H is a display of the zone and aggregate results of the reductions imposed during a stage of CARG-O. Each of the display matrix entries is preset to equal the appropriate cells from Section B. Shown beside the result matrices are the respective geographical representations of the referenced area (zones 1, 2, or 3) and a three-dimensional representation of the inventories (before and after the imposed reductions) (Figures 2-2 through 2-5).

ZONE 1 - BEGINNING INVENTORIES

	ROK	nK	US
TANKS	1150	1200	0
APC	980	1345	0
ARTY	1650	4850	0

ZONE 1 - REMAINING INVENTORIES

	ROK	nK	US
TANKS	575	600	0
APC	980	941	0
ARTY	858	2425	0

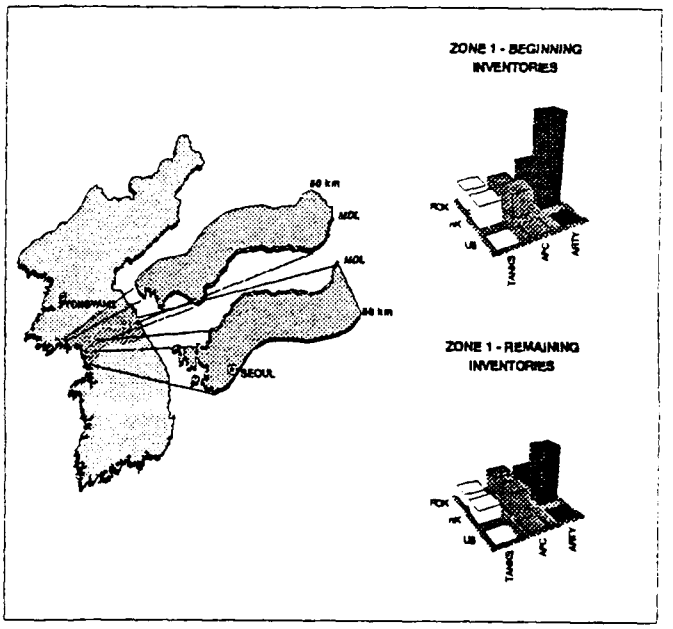

Figure 2-2. Zone 1 Beginning and Remaining Inventories (results matrix, geographical and 3-dimensional representations)

ZONE 2 - BEGINNING INVENTORIES

	nK	ROK	US
TANKS	1475	1250	198
APC	870	460	216
ARTY	4380	1235	49

ZONE 2 - REMAINING INVENTORIES

	nK	ROK	US
TANKS	737	1250	198
APC	870	460	216
ARTY	4380	997	49

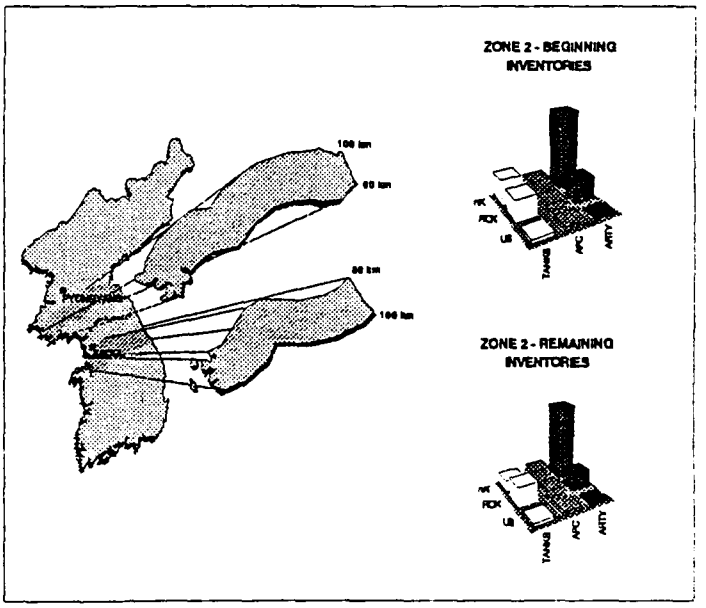

Figure 2-3. Zone 2 Beginning and Remaining Inventories (results matrix, geographical and 3-dimensional representations)

ZONE 3 - BEGINNING INVENTORIES

	nK	ROK	US
TANKS	320	280	0
APC	450	225	0
ARTY	1245	830	0

ZONE 3 - REMAINING INVENTORIES

	nK	ROK	US
TANKS	320	280	0
APC	450	225	0
ARTY	1245	830	0

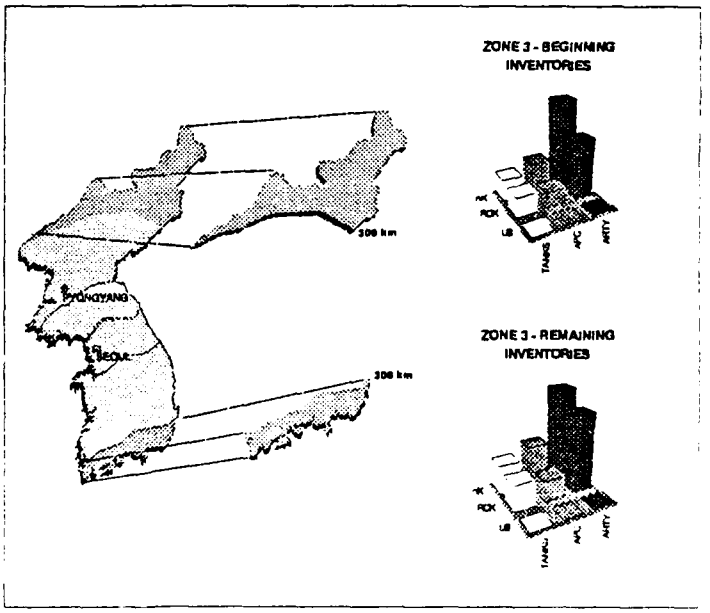

Figure 2-4. Zone 3 Beginning and Remaining Inventories (results matrix, geographical and 3-dimensional representations)

TOTALS (BEGINNING INVENTORIES)

	nK	ROK	US
ARTY	10475	3715	49
TANKS	2995	2680	198
APC	2665	1665	216
HELO	785	680	111
A/C	440	820	98

TOTALS (REMAINING INVENTORIES)

	nK	ROK	US
ARTY	8050	2685	49
TANKS	1657	2105	198
APC	2261	1665	216
HELO	785	340	111
A/C	440	410	98

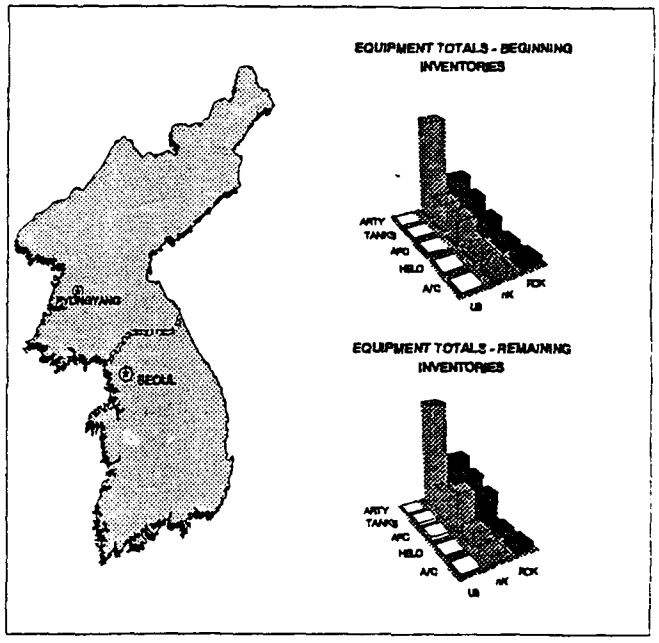

Figure 2-5. Aggregate Totals for Beginning and Remaining Inventories (Results Matrix, Geographical and 3-Dimensional Representations)

2-4. SPREADSHEET CONSTRUCTION

a. Spreadsheet software experience and a familiarization with algebraic expressions are necessary to construct the sections of the CARG-O spreadsheet. The only sections of the spreadsheet that need to be modified, after initialization, are sections A and B. For stages subsequent to the initial stage, Section A will always contain the "remaining inventories" of the preceding stage. Section B will always contain the valuation and reduction points assigned during a specific stage of CARG-O.

b. The following examples demonstrate the ease of spreadsheet cell construction:

(1) Each cell within a spreadsheet is referenced by a column location, denoted by a letter, and a row location, denoted by an integer. For example, the zone 1 tanks quantity for nK is located in cell B4 of Section A. To reference that number, for Section C, the operator highlights the appropriate cell within Section C and types the formula '=B4' for the cell entry. Most of the sections subsequent to Section B are constructed in this manner.

(2) Cells within some sections require the utilization of algebraic expressions. For instance, suppose the cell referencing tanks within the "ROK values nK Zone 1" row is being constructed, for Section E. The "Reduction by ROK" entry that pertains to this is located in cell B13 of Section B and the total reduction points imposed is

located in cell M13 of that same section. The operator highlights the appropriate cell within Section E and types '=Round(100*B13/M13,0)'. This expression divides the entry in cell B13 by the total reduction points in cell M13, multiplies the quotient by 100 and rounds the number off to the nearest integer value.

2-5. GRAPHICS INCORPORATION

a. To construct the three-dimensional representations of the separate output sections of the spreadsheet, the operator should proceed in the following manner:

(1) First, note that the spreadsheet was constructed within Excel 3.0 on a Macintosh system. For a very simplistic approach, assume that a 3-D graphic is being constructed for Section F of the spreadsheet. The operator highlights the entire section of the spreadsheet, to include the row and column headings. The "mouse" is then used to highlight the "File" reference, located along the top of the screen. With the mouse button held, a pull-down menu appears. The operator highlights the "New" reference and releases the button on the mouse. The operator now highlights the "Chart" reference. A two-dimensional representation of the referenced section now appears.

(2) It should be noted that the software package has now constructed a chart, separate from the spreadsheet, but specifically keyed to the highlighted section, Section F (it is technically located on the system clipboard). At this point, the operator can tailor the chart in whatever manner seems appropriate. For the purposes of the spreadsheet used in JKACS, a 3-D chart was constructed from here, using the options available within the menu items at the top of the screen. Specific items, such as axis scaling, rotation, orientation, and coloring can all be controlled by the operator.

(3) Once the graphic is constructed, the operator should highlight the entire chart and highlight the "edit" and "copy" references at the top of the screen. Now, the operator highlights the "window" reference and, in highlighting the spreadsheet "file" reference located underneath, can return to Section F of the spreadsheet. The operator highlights the cell where the chart's location is desired and once again highlights the "edit" and "paste" commands at the top. The chart should now appear in the referenced cell and can be adjusted according to desired size and location.

(4) Now that the 3-D chart is inherent to the spreadsheet, any changes within preceding sections of the spreadsheet, that affect this portion of the spreadsheet, will be automatically reflected in the 3-D chart. This is true of all 3-D charts within the spreadsheet; it provides an immediate visual representation of valuation and reduction strategies imposed during a CARG-O stage.

(5) The 3-D charts will automatically scale the vertical column to whatever the largest value is in the section. This is desired, in reference to the beginning inventories. However, in order to draw a valid comparison, the 3-D chart which references the remaining inventories of the respective section will have the vertical scale manually controlled by the operator, to equal the same scale as for the beginning inventory chart. This will be conducted for each stage of CARG-O, since the equipment categories will decrease over time.

b. To incorporate the geographical representations, any software package, such as Adobe Illustrator, can be used to initially draw the map, to include the highlighted zones. The maps are imported into the spreadsheet through the Paste Command

after copying graphics to the system clipboard. Trial and error, with sizing, location, and coloring, will result in the desired output presentation format. A "window" can then be created to border the geographic and 3-D representations, within which the individual borders are "hidden."

2-6. INPUT

a. As stated earlier, the only sections manually entered, once spreadsheet construction is complete, are Sections A and B. Section A is updated prior to a CARG-O stage, and Section B is updated as changes occur to permit immediate feedback of valuation and reduction strategies.

b. Detailed preliminary planning and research are necessary prior to the conduct of the game, specifically in reference to the use of any LDZs during the actual arms negotiations process. This is prerequisite to determining the initial disposition of forces, which represents the cell composition of Section A, CARG-O stage 1.

c. If the force dispositions are of a classified nature, any spreadsheets constructed on the hard drive will have to be removed. Floppy disks will have to be utilized and handled in the appropriate manner.

2-7. SPREADSHEET ENHANCEMENTS

a. One of the utilities available in the Excel 3.0 software package is known as "Macro." This utility allows the user to "program/record" commands as appropriate. Executing Macros facilitates making the software more user friendly.

b. A "GOTO Macro" file was created to provide responsive navigation abilities within the spreadsheet, precluding the user from having to move through the document with arrow or page keys. The individual sections of the spreadsheet were "titled", then referenced with "GOTO" commands, and linked to letter labels, using the section reference letters. For instance, from anywhere in the document, provided the Macro file is open, the user keys in the "open apple key" simultaneously with the letter "a," to move to Section A of the spreadsheet.

c. A "Preview Macro" file was created to provide responsive hard copy or screen view depiction of imposed valuations and reductions. The printing response time is directly related to the level of detail within the geographical and three-dimensional outputs. To provide immediate response time to the gamers, an onscreen preview of the print area proved most useful. To print/preview a section of the spreadsheet, the section must first be highlighted and then defined as the "Print Area" under the Options command. The File command is then referenced to obtain the print preview. The zoom option is used to provide a responsive and readable depiction of the results. All of these commands were incorporated into a Macro, during JKACS, to preclude the operator from several time consuming key strokes. If the Macro file is open, the user keys in the "open apple key" simultaneously with the letter "p" to immediately preview the results of the imposed valuation and reduction strategies. If a hard copy of the results is desired, the operator calls up the print command, since the print area has already been defined.

d. For the Macros to be "online", the operator must open each respective file for use at any time during operations with the spreadsheet. Three files are open at the same time--the spreadsheet file, the Preview Macro, and the GOTO Macro.

2-8. OUTPUT. As noted above, there are two specific types of output used with this model; screen visualization and printed form. The preview Macro automatically creates an on screen viewing capability. The print function is used to obtain a hard copy of the results.

2-9. CARG-O LESSONS LEARNED DURING JKACS

a. Class Demonstration

(1) A demonstration of the CARG-O model is necessary for operators to understand the functions/utility of the model in connection with the arms control process. Their level of mastery has a direct impact on the utility of the process inherent to the game itself.

(2) It is also necessary for the gamers, who provide the input to the model, to understand the implications of the valuation and reduction strategies imposed during actual CARG-O stages. The gamers should not attempt to undermine the integrity of the game, by using a "gaming" strategy instead of complete honesty, especially during the valuation move.

b. Realism

(1) If LDZs, or a like facsimile, are used in CARG-O, those LDZs should be based on a sound, rational and methodological approach to an arms control reduction strategy that is acceptable to both sides of the arms control negotiations. The more realistic the LDZs, the better the process, inherent to CARG-O, is understood. The original assumptions concerning the use of symmetrical LDZs in CARG-O were not readily acceptable. Additionally, the concept of a 200-kilometer zone with a stipulation of no forces deployed within it resulted in strong debate. This was especially true since Pyongyang was located within this zone.

(2) An interesting by-product of the LDZ concept incorporated in CARG-O is as follows:

(a) CARG-O had been completely designed and constructed prior to the initiation of JKACS. Some of the assumptions concerning its design, however, proved invalid, specifically the LDZ specifications.

(b) In response to necessary modifications, the spreadsheet was essentially rebuilt with new three-dimensional charts and geographic representations within a 6-hour timeframe. Although this modification proved inconsequential, it demonstrates the ease of the spreadsheet construction.

(3) All factors relating to the CARG-O game need to be established and agreed to by all gamers prior to the actual conduct of the game; factors such as parity, reduction points, number of CARG-O stages and reduction points per stage, and the implications related to ceiling figures imposed before or after the use of CARG-O.

(4) One of the criticisms of CARG-O, voiced during JKACS, was the unrealistic assumption that asymmetric reduction strategies imposed during the game would be acceptable to both sides. In conjunction with this, it was also stated that if categorical ceilings were agreed to in the negotiations process, then CARG-O is of no value other than an appreciation of the thought processes involved.

2-10. FUTURE APPLICATIONS

a. CARG-O's objective is not to simulate the arms control process, but rather to force people to think about arms control issues in a dynamic and interactive environment. The game mechanics do not simulate arms control; they cause people to act upon their thoughts and conceptions about arms control in a group dynamic environment. Since the gamer must act upon his/her convictions rather than internalize them, this forces one to examine arms control issues more carefully and comprehensively. The gamer is required to interact in a dynamic mode with other subject matter experts who hopefully are also very knowledgeable but whose knowledge covers at least a portion of an area of arms control that the gamer is not well acquainted with. This provides for group synergism so that the results of discussions on arms control issues will be much greater than the individual contributions. It should also be recognized that in this game, there is not only interaction within each group, but also interaction between the groups which significantly enhances the power of the game.

b. CARG-O is more than a tool. It is designed to provide the gamers with orientation and insight into the complexities involved in conducting arms control negotiations. But, if facets of the game itself seem unrealistic, this adversely affects the intent of its use. The importance of CARG-O is not necessarily an understanding of the game, but an appreciation of the process, the thought process involved in placing a numerical value on one's own forces, the thought process related to the reduction points imposed on the other side's forces, and most importantly, the strategic linkage/implications inherent to both.

c. CAC will use the CARG-O model to support future arms control studies, specifically within the JKACS scenario, and generically within any applicable environment.

d. CARG-O enhancement:

(1) To offset some of the criticisms of CARG-0, the following enhancements can be incorporated:

(a) Determine the reduction percentage based on the valuation and reduction values, displayed in Section B of the spreadsheet.

(b) Calculate the average of the two reduction percentages for each column of the section.

(c) Impose the adjusted reduction percentage to each of the forces involved in the negotiations.

(2) The example shown in Table 2-8 illustrates the adjusted reduction percentages imposed as a result of using Section B figures discussed previously.

Table 2-8. Adjusted Reduction Percentages

SECTION B	ZONE 1 TANKS	ZONE 2 TANKS	ZONE 3 TANKS	ZONE 1 APCS	ZONE 2 APCS	ZONE 3 APCS	ZONE 1 ARTY	ZONE 2 ARTY	ZONE 3 ARTY	HELO	A/C	TOTAL
OPFOR												
nK VALUES FORCE	18	14	5	10	6	5	22	8	2	5	5	100
REDUCTION BY ROK	9	7	0	3	0	0	11	0	0	0	0	30
REDUCTION %	50	50	0	30	0	0	50	0	0	0	0	
FRNDFOR												
ROK VALUES FORCE	16	8	2	10	4	1	25	13	6	7	8	100
REDUCTION BY nK	8	0	0	0	0	0	12	2.5	0	3.5	4	30
REDUCTION %	50	0	0	0	0	0	48	19.2	0	50	50	
AVERAGE REDUCTION %	50	25	0	15	0	0	49	9.6	0	25	25	

(3) The advantages of this methodology are:

(a) The adjusted reduction percentages are inherently related to the valuation and reduction strategies, thereby accounting for the concerns of both sides.

(b) The adjusted reduction strategy is imposed on both sides, thereby eradicating the asymmetric reduction concerns.

(c) The adjusted reduction strategy may be more closely aligned with actual arms negotiations' processes, in that a "give and take" scenario is generated based on the concerns of both sides, as drawn from their numerical force and threat valuations.

(4) An alternate enhancement can be to actually conduct an arms negotiations discussion, within a plenary session, upon completion of imposed reductions.

APPENDIX A

CARG-O GAMER INSTRUCTION SHEET

This appendix presents a copy of the CARG-O gamer instruction sheet in the JKACS political-military game. Some of the preliminary information, specifically that concerning team structure, was modified. The information as presented on this instruction sheet reflects what was originally planned.

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CONVENTIONAL ARMS REDUCTION GAME - OPTIMIZED (CARG-O)

INSTRUCTIONS

A. Introduction. CARG-O is a computer-assisted interactive model designed to provide orientation /insight into the complexities involved in conducting arms negotiations. The use of CARG-O compels gamers to define their team's strategy and the relative value of their team's force, and to propose a possible negotiating policy. The CARG-O method assesses which forces are highly valued and which are perceived as most threatening by each team.

B. Methodology

- **Team Structure.** For the purposes of JKACS, gamers will be divided into three teams representing the US, the ROK, and the DPRK. The US and ROK meet separately to conduct their own force evaluations, of both US and ROK forces, and then meet to negotiate a single arms control position. The purpose of separating the ROK and the US is to explore the differences that exist between the interests of the two countries and explore how these differences might be resolved. Once the US-ROK evaluation is complete, the negotiations are conducted bilaterally between the US-ROK and the DPRK. Reductions of the opposing side's forces are conducted bilaterally.

- **Define Objectives and Develop Strategy.** CARG-O begins with each team meeting separately to define its arms control objectives and develop a strategy to pursue those objectives within the structure of the exercise.

- **Assign Values.** Using its array of available forces, the team then applies its strategy by assigning values (point system) to their own force list. Each team is provided with a force list detailing its ground and air units, divided into five categories: tanks, armored personnel carriers (APC), artillery, helicopters, and aircraft. Only equipment stationed on the peninsula is included in the equipment totals. The teams assign 100 points to their equipment categories based on their assessment of equipment value. For example, a team assigns its tanks, 30 points; APC, 20; artillery, 20; helicopters, 20; and aircraft, 10.

- **Exchange Values.** The resulting team worksheets (showing assigned values to equipment categories) are then exchanged and teams select arms control reduction strategies.

- **Impose Reductions.** Again referring to its strategy, each team determines and imposes reductions on the other's force array up to a common announced point limit. For example, a combination of opposing forces totaling 20 points.

- **Return Worksheets.** Worksheets are then returned, and teams invited to weigh the impact of reductions imposed and revisit their strategies as they re-value their force arrays back to the original ceiling.

- **Assess Results.** This completes an iteration of play, which can now be repeated as many times as is deemed instructive. The Concepts Evaluation Model (CEM) will be used to evaluate the effect of each side's reductions, using the resulting CARG-O output valuations.

APPENDIX B

CARG-O WORKSHEET

This appendix presents a copy of the worksheet for the utilization of CARG-O in the JKACS political-military game.

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CARG-O WORKSHEET

DPRK

	ZONE 1			ZONE 2			ZONE 3		
	INV	VAL	RED	INV	VAL	RED	INV	VAL	RED
TANKS	___	___	___	___	___	___	___	___	___
APCS	___	___	___	___	___	___	___	___	___
ARTY	___	___	___	___	___	___	___	___	___
HEL	___	___	___						
A/C	___	___	___						

ROK

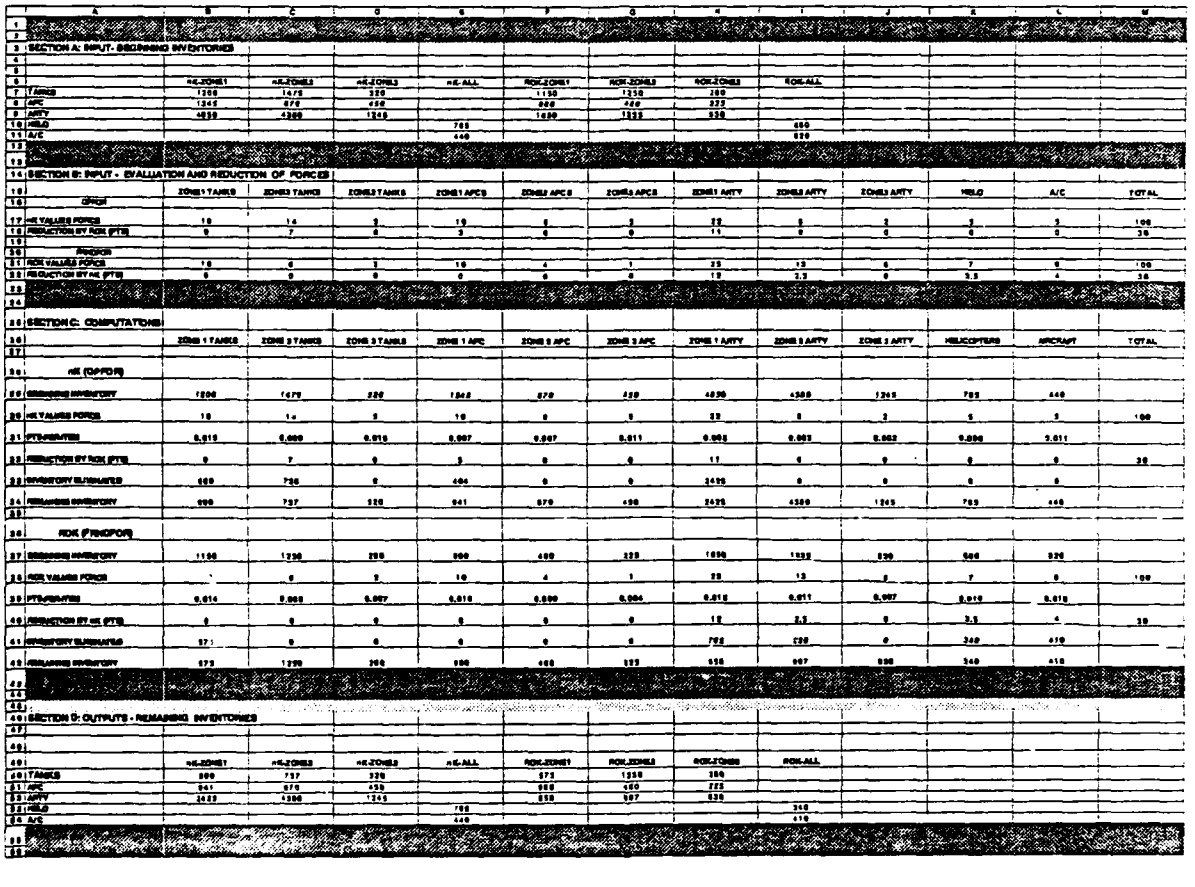
	ZONE 1			ZONE 2			ZONE 3		
	INV	VAL	RED	INV	VAL	RED	INV	VAL	RED
TANKS	___	___	___	___	___	___	___	___	___
APCS	___	___	___	___	___	___	___	___	___
ARTY	___	___	___	___	___	___	___	___	___
HEL	___	___	___						
A/C	___	___	___						

INV = INVENTORY, VAL = FORCE VALUATION, RED = REDUCTION

APPENDIX C

CARG-O SPREADSHEET

This appendix presents a copy of the spreadsheet for the utilization of CARG-O in the JKACS political-military game.



COPY FURNISHED TO DTIC DOES NOT PERMIT FULLY LEGIBLE REPRODUCTION

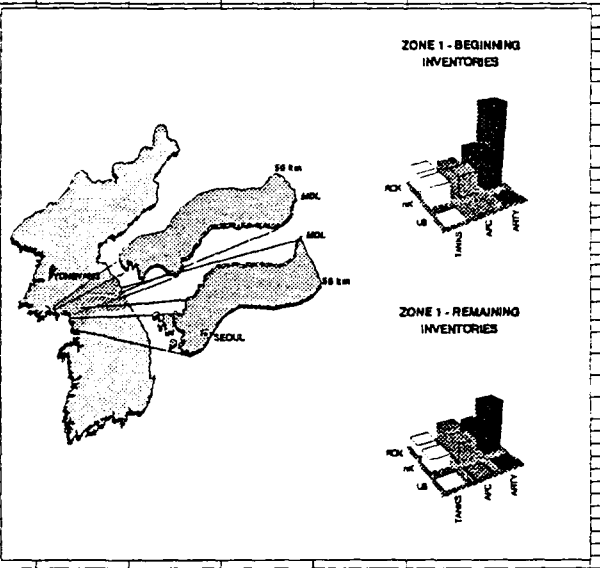
	A	B	C	D	E	F
55						
56						
57						
58	SECTION E - FORCE VALUATIONS					
59						
60		HELICOPTERS	AIRCRAFT	TANKS	APCS	ARTILLERY
61	nK VALUES ROK ZONE1	12	13	27	0	40
62	nK VALUES ROK ZONE 2			0	0	8
63	nK VALUES ROK ZONE 3			0	0	0
64	ROK/US VALUES ROK ZONE1	7	8	16	10	25
65	ROK/US VALUES ROK ZONE 2			6	4	13
66	ROK/US VALUES ROK ZONE 3			2	1	6
67						
68	nK VALUES nK ZONE 1	5	5	16	10	22
69	nK VALUES nK ZONE 2			14	6	6
70	nK VALUES nK ZONE 3			5	5	2
71	ROK/US VALUES nK ZONE 1	0	0	30	10	37
72	ROK/US VALUES nK ZONE 2			23	0	0
73	ROK/US VALUES nK ZONE 3			0	0	0
74						
75						
76	SECTION F : EQUIPMENT TOTALS (BEGINNING INVENTORIES)					
77						
78						
79		nK	ROK	US		
80	ARTY	10475	3715	48		
81	TANKS	2995	2660	198		
82	APC	2865	1885	218		
83	HELO	785	650	111		
84	A/C	440	820	88		
85						
86						
87	SECTION G : EQUIPMENT TOTALS (REMAINING INVENTORIES)					
88						
89						
90		nK	ROK	US		
91	ARTY	8050	2885	48		
92	TANKS	1857	2105	198		
93	APC	2201	1885	218		
94	HELO	785	340	111		
95	A/C	440	410	88		
96						
97						

ZONE 1 - BEGINNING INVENTORIES

	ROK	nK	US
TANKS	1150	1200	0
APC	980	1345	0
ARTY	1650	4850	0

ZONE 1 - REMAINING INVENTORIES

	ROK	nK	US
TANKS	575	600	0
APC	980	941	0
ARTY	858	2425	0

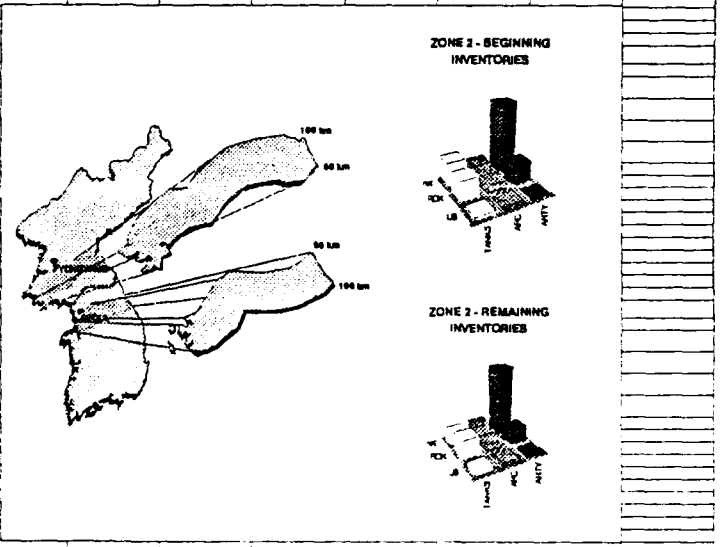


ZONE 2 - BEGINNING INVENTORIES

	nK	ROK	US
TANKS	1475	1250	198
APC	870	460	216
ARTY	4380	1235	49

ZONE 2 - REMAINING INVENTORIES

	nK	ROK	US
TANKS	737	1250	198
APC	870	460	216
ARTY	4380	997	49

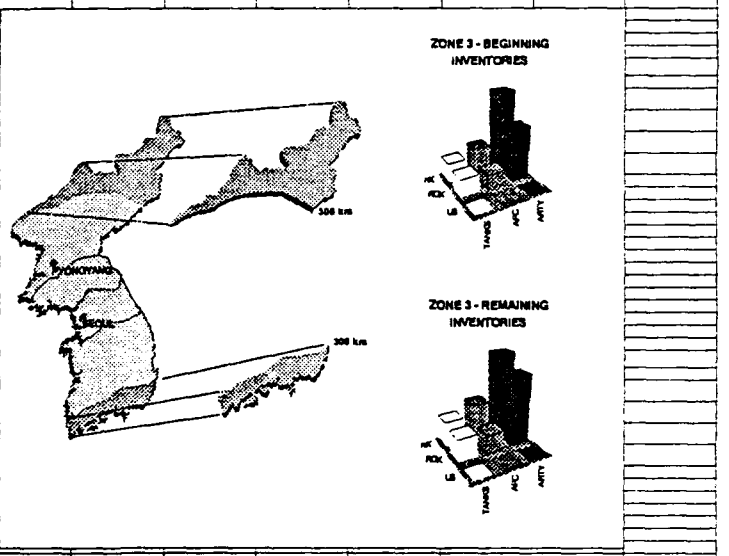


ZONE 3 - BEGINNING INVENTORIES

	nK	ROK	US
TANKS	320	280	0
APC	450	225	0
ARTY	1245	830	0

ZONE 3 - REMAINING INVENTORIES

	nK	ROK	US
TANKS	320	280	0
APC	450	225	0
ARTY	1245	830	0

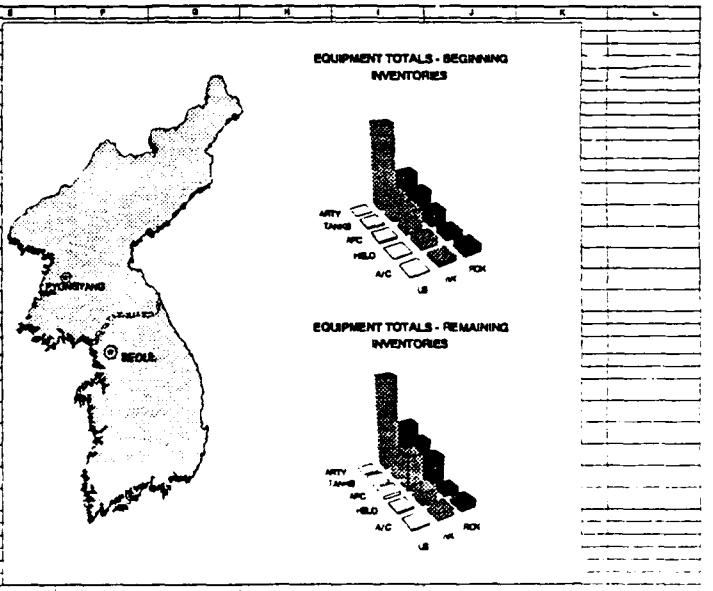


TOTALS (BEGINNING INVENTORIES)

	nK	ROK	US
ARTY	10475	3715	49
TANKS	2995	2680	198
APC	2865	1665	216
HELO	785	680	111
A/C	440	820	98

TOTALS (REMAINING INVENTORIES)

	nK	ROK	US
ARTY	8050	2685	49
TANKS	1657	2105	198
APC	2261	1665	216
HELO	785	340	111
A/C	440	410	98



APPENDIX D

KOREA INSTITUTE FOR DEFENSE ANALYSES (BACKGROUND INFORMATION)

This appendix was extracted from a *KIDA information* publication.

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D-1. Background. As the walls between ideologies and political institutions come down, a new era of worldwide reconciliation and cooperation based on mutual respect and trust is beginning to blossom. For the Republic of Korea (ROK), the arrival of the "Pacific Era" coupled with our economic development mandates a greater contribution to world peace and prosperity. To meet this requirement and maintain stability on the Korean peninsula, we must devise a new defense policy in preparation for national reunification talks with North Korea and for a restructuring of ROK-US security relations based on equal partnership.

D-2. History

a. The Korea Institute for Defense Analyses (KIDA) was founded in 1979 as an organization affiliated with the Agency for Defense Development (ADD) to provide the ROK Ministry of National Defense (MND) with policy alternatives.

b. Following a steady expansion of the capacity and scope of its contributions to national defense policy, the Institute separated from the ADD and became an autonomous, non-profit research organization, fully sponsored by the government in March 1987.

c. In March 1990, to provide the MND with arms control negotiation policy alternatives, the Institute established the Arms Control Research Center as an affiliated organization.

d. In January 1991, the Center for Weapon Systems Studies was also established as an affiliate to provide weapon systems acquisition policy alternatives.

e. In January 1992, KIDA created the Institute for Defense Information Systems as an attached organization.

D-3. Major Function. The Institute is devoted to research on strategic environment, security policy, national defense strategy, force development, defense economy, weapon systems acquisition policy, defense automation and arms control.

D-4. Arms Control Research Center. The center is providing support directly to the MND in the development of mid- and long-term arms control strategy and measures for inter-Korea military talks. The major research areas of the center are arms control environment, arms control policy alternatives, arms control verification regime, and strategic arms control schemes.

a. Arms Control Environment. Focus is on the analysis of arms control policies of the four major regional powers, North Korea's policy toward the South, and South Korea's policy toward the North, which are all closely related to arms control on the Korean peninsula. Of special issue are the impact of the US-Soviet conventional arms control talks on the peninsula, the role of US Forces in Korea to South-North arms control talks, the analysis of North Korea's arms control proposals, and the long-term arms control incentives and disincentives for the North. Accordingly, due efforts are made in the assessment of North Korea's military, social, economic, and political changes.

b. Arms Control Policy Alternatives. Study in this area is to investigate alternative policies for confidence-building measures, arms limitation and reduction measures, negotiation strategy and its related regulation to enhance military stability on the peninsula. To evaluate policy alternatives, both static and dynamic

analyses including wargaming and computer simulation come extensively into use. Particular attention is given to devising effective bargaining chips for inter-Korea high-level military talks. Arms control regulation, which is related to the processes of negotiation, agreement and implementation, is also examined in view of legal considerations.

c. Arms Control Verification. This area investigates arms control verification policy and its technological requirements. The means and methods to be used in verification, with special attention paid to their applicability to the Korean situation, are examined in terms of satellites, aircraft, ground sensors, and on-site inspection. The study also covers overall verification schemes that include procedural, organizational, financial and technical factors for various verification policy alternatives.

d. Strategic Arms Control. The focus is on the analyses of international regulations on the CBR weapons and missiles as strategic arms along with investigation of its related effects on the Korean peninsula. This study also concerns the development of South Korea's negotiation strategies toward North Korea and mutual effective regimes of inspection and verification for nuclear, chemical, and biological weapons including long-range missiles.